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(54) **DEVICE FOR CATCHMENT OF PLATINUM GROUP METALS IN A GAS STREAM**

VORRICHTUNG ZUM EINFANGEN VON PLATINGRUPPEMETALLEN IN EINEM GASSTROM

DISPOSITIF POUR LA CAPTURE DE MÉTAUX DU GROUPE DU PLATINE DANS UN EFFLUENT GAZEUX

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(56) References cited:
EP-A- 0 185 510
EP-A- 0 275 681
DE-A1- 2 855 102
GB-A- 1 237 032
GB-A- 1 314 874
GB-A- 1 343 637
US-A- 4 774 069
US-A- 5 478 549

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EP 2 064 357 B1

Description

[0001] This invention relates to a method and device for catchment of platinum group metals (PGM) in a gaseous stream.

Background

[0002] The main industrial process for producing nitric acid is known as the Ostwald route where ammonia, NH_3 is oxidised over a combustion catalyst at temperatures in the range of 800 to 1100 °C to form nitrogen monoxide, NO. The pressure ranges from atmospheric pressure to 10-12 bar. The formed nitrogen monoxide is quenched, mixed with air to form nitrogen dioxide, NO_2, and then the nitrogen dioxide is allowed to react with water to form nitric acid, HNO_3.

[0003] The typical combustion catalyst is one or more stacked gauzes made of woven or knitted wires of platinum alloyed with rhodium, and traces of grain refining elements. During operation the combustion catalyst loses platinum and to a lesser extent rhodium via the volatisation of PtO_2 and RhO_2. Thus it is common industrial practise to place catchment gauzes downstream of the combustion gauzes in order to recover a proportion of the platinum loss.

Prior art

[0004] The current PGM-catchment technology is based on palladium or palladium based alloys (palladium, containing small amounts of platinum, and silver, gold, cobalt or nickel). The catchment alloy is installed in the form of gauzes, directly downstream of the platinum-based combustion gauzes. Typically, the catchment gauze is produced from 60 to 90 micron wire and is woven with a 1024 mesh (32 wires per linear cm), and 3 or 4 catchment gauzes would be installed.

[0005] The benefits of installing the catchment alloy in the form of a gauze are two-fold. In terms of their production, the catchment systems are made using the same technology as the combustion gauzes. The production method is therefore well known and proven. The main technological advantage of a gauze-based catchment system is the very high mass transfer characteristics of gauzes.

[0006] However, installing the catchment alloy in the form of gauzes has a number of disadvantages. Producing gauzes is a relatively expensive production process (producing wire and weaving or kitting the wire). To aid wire production the palladium is typically alloyed with a base metal, which evaporates in operation and thus continuously transports metal into the plant boilers). The surface area of a typical gauze (76 micron-1024 mesh) is relatively low (initially 1.5 cm^2 of metal per cm^2 of gauze). As the total catchment zone is narrow (0.4 to 0.6 mm) all the recovered platinum is located within this zone. Therefore, during a campaign, the openings in the catchment gauzes become progressively blocked. This leads to a large increase in pressure drop across the pack. A further problem related to the catchment gauzes is that the platinum -palladium alloy, that is formed during the catchment process, becomes embrittled. This, combined with the additional mechanical load on the gauzes, caused by the increased pressure drop, may lead to physical break-down of the gauzes.

[0007] From EP 0 275 681 it is known a catalyst pack for the manufacture of nitric acid by oxidising ammonia comprises at least one layer of elongate elements made from at least one platinum group metal or alloy and at least one foraminous layer of ceramics material having a coating of one or more platinum group metals or alloys or mixture. In use the catalyst pack has improved conversion efficiencies. The preferred ceramics material comprises either alumina, silica and boria or zirconia in the form of a cloth.

[0008] From US 5 478 549 it is known a process for the manufacture of nitric oxide by oxidizing ammonia in which the amount of nitrous oxide, i.e., N_2O, by-product is lowered, which comprises passing a gas stream containing ammonia and oxygen in contact with a catalyst containing platinum group metal under conditions such that nitric oxide and nitrous oxide will be formed in the stream, then passing the stream in contact with a catchment trap where platinum group metal oxides that were volatilized during the prior step are recovered, and then dispersing the stream through a bed containing zirconium oxide where the steam is contacted with the zirconium oxide, and the nitrous oxide is converted to nitrogen and oxygen. The catchment trap will consist of three layers of interstitial ceramics cloth interleaved with two layer of palladium scavenger-wire. The ceramics cloth will consist of a ceramics material composed of 62 wt. % alumina, 24 wt. % silica and 14 wt. % boria formed into fibres of diameter 11 mum which, in turn, will be spin into threads and woven to make a cloth of mesh size 50 interstices per sq. cm. which will give the cloth an open area of 52.6%. The palladium layers will consist of palladium wire of diameter 0.080 mm woven into a gauze of mesh size 1024 interstices per sq. cm., giving an open area of 55%. The catchment pack will be wrapped in heat-resistant woven metal gauze.

[0009] From US 4 774 069 it is known a process for the manufacture of nitric oxide by the oxidation of ammonia using a catalyst comprising platinum in which the ammonia conversion efficiency of the process is improved by the use of a palladium catchment trap in which the conventional layers of palladium scavenger-wire are adjacent to layers of interstitial (preferably woven) ceramics material. The preferred ceramics material consists of alumina, silica and boria. The document also discloses a catchment trap for use in the manufacture of nitric oxide by oxidising ammonia in the presence of a platinum-based catalyst wherein the catchment trap comprises at least one layer of interstitial elongated elements made

from palladium or an alloy of palladium supported on at least one layer of interstitial ceramics material which is preferably a layer of ceramic fibres which may be in the form of a woven cloth where the interstices are provided by the gaps in the weave. Preferably the catchment trap comprises at least five interstitial layers of palladium elongated elements interleaved with layers of interstitial ceramics material. Usually the trap will comprise from 2 to 30 layers of palladium scavenger-wire interleaved with a corresponding number of layers of interstitial ceramics material. Preferably the layers of the catchment trap are enclosed by a metal gauze wrapping.

[0010] From EP 0 185 510 it is known catchment packs of the type commonly utilized in platinum metal-catalysed ammonia oxidation plants for the manufacture of nitric acid. In more detail there is disclosed a catchment pack suitable for locating downstream of a platinum group metal catalyst in an ammonia oxidation reactor for the purpose of recovering volatilised platinum group metal or oxides thereof and comprising getter material in the form of an agglomeration or assemblage of unwoven randomly oriented fibres sandwiched between support gauzes made from an oxidation-resistant material, wherein the pack comprises a plurality of segments arranged in the same plane so as substantially to cover the cross-sectional area of the reactor; each segment containing said fibres sandwiched between said support gauzes in substantially stable regular distribution and having at least one essentially straight edge contiguous with an essentially straight edge on an adjacent segment.

[0011] From GB 1 343 637 it is known process for recovering platinum metals entrained in a hot gas stream comprises passing the gas through a gettering device in the form of an inert ceramic honeycomb structure 1 which is coated with a getter containing gold to absorb the platinum, thereafter removing the coating and platinum from the structure 1 with an acid, and recovering the gold and platinum from the acid. The getter coating may also include, silver, palladium, platinum and alloys thereof, and minor amounts of rhodium, ruthenium and iridium to impart thermal stability to the gold coating.

[0012] From GB 1 314 874 it is known a filter for capture of noble metal which is being carried in dispersed or vaporized form in a product gas, the filter comprising one or more layers of a heat-resistant mineral wool material, each layer of which does not occupy the whole cross-sectional area of the filter chamber whereby a portion of the gaseous product may pass through the filter chamber without passing through the mineral wool material.

[0013] From JP 06 1920253 it is known a film member superior in heat resistance and to provide a method for producing a film member by which a film member made of ceramics, especially, a hollow fibre membrane is easily subjected to metallic coating. The high purity alumina hollow fibre membrane is etched by immersing it in aq. hydrogen chloride solution. Subsequently the hollow fibre membrane is immersed in the solution of $PdCl_2$, HCl and $SnCl_4$, thus Pd-Sn alloy is perfectly fixed onto the surface of the hollow fibre membrane. Next the hollow fibre membrane is immersed in a weakly alkaline Ni-ion solution and subjected to electroless plating treatment to obtain the hollow fibre membrane coated with metal Ni.

Objective of the invention

[0014] The main objective of this invention is to provide a method and device for catching platinum group metals in a gaseous stream that solves the above-mentioned problems.

[0015] The objectives of the invention may be obtained by the features set forth in the following description of the invention. The invention is defined by the features detect in the appended claims.

Description of the invention

[0016] The invention utilises the realisation that gaseous streams through porous ceramic structures are substantially turbulent and that porous materials have relatively huge surface areas allowing excellent contact area between the flowing gas and the ceramic wall material, which leads to the favourable combination of high mass transfer coefficient of gaseous components onto the ceramic wall material and a huge surface area.

[0017] In a first aspect, the invention relates to a porous ceramic body having at least a part of its surface area covered by one or more PGM-catching metal(s) and/or alloy(s). The ceramic body is be a ceramic foam or sponge. Suitable ceramics are be one or more of the following: zirconia, alumina, alumino-silicate, but may also be of any ceramic or metallic material which may be coated with one or more metallic catalyst material(s) and which exhibits the necessary mechanical strength and chemical properties to withstand the conditions encountered in ammonia burners. The porosity of the ceramic body is be in the range of 50 to 98 % with a preferred pore size, defined by the number of pores per linear inch, in the range of 5 to 120 ppi. This corresponds to about 2 to 50 pores per cm. The deposited layer of one or more PGM-catching metal(s) and/or alloy(s) may have a thickness in the range from about 1 nm up to about 150 micron. The porous ceramic body may advantageously have all surface area covered by the one or more PGM-catching metal(s) and/or alloy(s) and the applied gas pressure may advantageously result in turbulent gas streams flowing through the channels in the ceramic body.

[0018] The surface area of ceramic foams according to the invention is comparable to that of a widely used monolith

structure, with the same characteristic dimension (channel size and pore size). However, the mass transfer coefficient for a sponge of foam is comparable with that of wire gauzes, which is significantly higher than of a monolith, as turbulent flow is present throughout the depth of the sponge. Thus the invention provides a support system having a contact area greater than can be practically achieved with gauzes, but with a comparable mass transfer coefficient.

[0019] Currently, the most common catchment alloys are based on palladium, with the addition of alloying components to improve the wire drawing, weaving or knitting properties. Examples of the systems include Pd-Au, Pd-Co and Pd-Ni binary alloys. Trace quantities of grain refining elements may also be present.

[0020] An advantageous method for depositing the one or more PGM-catching metal(s)/alloy(s) onto the ceramic foam is electroless plating, which is an autocatalytic coating method that allows both electrically conducting and insulating materials to be coated with a uniform metallic layer. In this method the ceramic object to be coated is activated by sequentially dipping into a tin solution and a palladium solution. The tin is adsorbed onto the surface as a Sn^{2+} species, in submonolayer quantities. When the palladium contacts the Sn^{2+}, it will become reduced to metallic palladium:

$$Sn^{2+} + Pd^{2+} \rightarrow Sn^{4+} + Pd°$$

[0021] After the activation process, the ceramic sponge is placed in a solution containing the metal that is to be deposited, which in our application is palladium, along with a reducing agent, such as hydrazine. The metallic palladium on the surface acts as a catalyst for the reduction of more palladium, by the hydrazine. By this means, a uniform layer of metallic palladium is deposited onto the surface. The coating thickness may be controlled by varying the coating time and the solution chemistry.

[0022] The palladium coating is deposited onto the surface of the support sponge via an electroless plating technique. The process involves an activation step and a coating step. The activation step consisted of the immersion of the sponge into a solution of tin (II) chloride; rinsing with deionised water and immersion into a solution of palladium chloride. The activation step was repeated between 5 and 10 times. During the activation process, the colour of the sponge changes to a pale grey colour. An example of the composition of an activation solution is shown in Table 1.

Table 1. An example of the compositions of an activation solution

$SnCl_2.2H_2O$	1 g/l
HCl (37 %)	1 ml/l
Temperature	25 °C
$PdCl_2$	0.1 g/l
HCl (37 %)	1
Temperature	25 °C

[0023] After the activation of the sponge, it may be coated with palladium. The coating solution consists of an aqueous solution of palladium tetra-amine dichloride ($Pd(NH_3)_4Cl_2.4H_2O$, which had been complexed with disodium ethylenediaminetetraacetic acid dehydrate (Na-EDTA), along with ammonium hydroxide, for a minimum of 12 hours. Just prior to the coating operation, the solution was heated to 60 °C, and then hydrazine was added to the coating solution. An example of the composition of a coating solution is shown in Table 2. The coating solution is contacted with the sponges in a flow system, such that the solution flows through the sponge, or a series of sponges and after passing through them, is recycled. The solution is passed through the sponges for between 10 minutes and 1 hour.

Table 2. An example of the composition of a coating solution

$Pd(NH_3)_4Cl_2.H_2O$	4 g/l
Na_2-EDTA.$2H_2O$	40.1 g/l
NH_4OH (28%)	198
Metal concentration	16.3 mM
Ph	10 - 11
Temperature	60 °C

[0024] The thickness or palladium loading on the sponge is readily controlled by the temperature and time of the

coating process. High temperatures and long time favour thicker coatings. If a thick layer of palladium is required, the coating solution may be replaced after a period of time.

List of figures

[0025]

Figure 1 shows a micrograph of a palladium coating on a zirconia sponge according to the preferred embodiment of the invention.

Figure 2 is a close up of the interface region shown in Figure 1.

Figure 3 is a graph showing the platinum uptake of the preferred embodiment.

Verification of the invention

[0026] The invention will be described in further detail by way of two verification experiments. These should not be considered as a limitation of the general inventive concept of employing a porous ceramic structure coated with one or more PGM-catchment alloy(s).

First verification experiment

[0027] A coated sponge was prepared by electroless plating. The zirconia sponge (45 ppi) was coated with 55.4 mg Pd per cm^3 sponge. The coated sponge (8.36 cm^3 containing 463 mg of palladium) was placed in a reactor, downstream of a source of platinum oxide vapour. The reactor was heated to 900 °C with a flow of air of 300 litres per hour. Platinum was evaporated at a rate of 0.22 mg per hour. After 335 hours, approximately 74 mg of platinum had passed through the sponge.

[0028] The sponge showed a weight increase of 67 mg. The sponge was washed in aqua-regia at 80 °C to dissolve all the platinum and palladium. The resulting solution was analysed by Inductively-Coupled Plasma Spectroscopy (ICP) to determine the platinum and palladium content. ICP analysis indicated that the sponge contained 66 mg of platinum and 462 mg of palladium. This indicates that 89 % of the platinum was recovered. This value is at the very high end of what may be achieved with a standard gauze-based catchment system. Typically, platinum varies from 80 to 85 %, although lower and higher values are achieved in some campaigns. It is also possible that less than 74 mg of platinum passed through the sponge, during the catchment test (deposits on the wall of the reactor or on the platinum filament support. In that case, the true catchment efficiency exceeds 89 %.

[0029] A profile of platinum uptake on a Pd-coated sponge, after a two-week catchment test, was determined using SEM analysis. The profile is shown in Figure 3. It is observed that after the two-week exposure to platinum vapour, the platinum is recovered in the first few millimetres of the sponge. It is anticipated that as the mass transfer coefficient will be high throughout the length of the sponge, the high recovery efficiency of platinum would continue.

Second verification experiment

Preparation of sponges

[0030] Zirconia sponges, with a cell size of 80 pores per inch (ppi), were produced in a size of 4.8 x 4.8 x 1.0 cm. These sponges were coated with palladium via the electroless plating technique, to give a palladium loading of approximately 3 g per sponge, which is equivalent to 0.13 g per cm^2 of sponge, as it is installed in the reactor (3 g/(4.8 x 4.8 cm)).

[0031] This palladium loading is comparable to the loading of 4 x 76 micron palladium recovery gauzes, woven with a 1024 mesh geometry.

[0032] To fit into the circular pilot-reactor (23 cm diameter), nine whole sponges are installed in a 3 x 3 configuration, at the centre of the reactor, and sponges are then cut to shape to fill the gaps in the bed.

Testing of sponges

[0033] The sponges and gauzes, were loaded into the reactor in the following manner (from the top or in the direction of gas flow):

1. 5 x combustion gauzes composed of a proprietary Yara design

2. The first layer of the palladium coated sponge (10 mm thick)

3. A wire screen composed of a heat resisting alloy

4. The second layer of the palladium coated sponge (10 mm thick)

5. A wire screen composed of a heat resisting alloy

6. 2 x palladium gauzes (76 micron and 1024 mesh)

[0034] The heat resisting alloy screens are to aid the separation of the screens after pilot plant testing. The 2 x palladium gauzes are a conventional platinum recovery system.

[0035] The above system is installed in the pilot reactor. 10.5 % ammonia in air mixture is used as the feedstock, and the plant is run at 900 °C and 5 bar pressure. The gas load is calculated to give a 10 ton nitrogen/m^2 reactor/day.

[0036] After running for approximately one week, the above combustion and recovery system is removed from the pilot-plant. After weighing the gauzes, a circular patch, above the centre of one of the sponges is cut out. A patch of the palladium gauze located below the centre of the sponge is also removed. The upper and lower sponges are removed and replaced with fresh sponges. Patches of the combustion gauzes and the recovery gauzes are placed in the holes from where the gauze samples were taken. The whole pack is then reinstalled in the pilot plant and combustion of ammonia commenced. After a further week, the above sampling procedure was repeated.

[0037] The weighed gauzes and sponges were soaked in hot aqua-regia, to dissolve all the platinum, rhodium and palladium. In the case of the sponges, after washing and drying, the sponges were weighed again, to show the loss of metal. After dilution, the composition of the acid solutions were analysed by Inductively-Coupled Plasma Spectroscopy (ICP).

[0038] The above procedure allows the mass balance of the system to be determined, thus giving the efficiency of the platinum recovery and palladium loss of the sponge system. The presence of conventional palladium gauzes below the sponges, are in place to demonstrate, categorically, if platinum is passing through the sponges.

[0039] The sampling procedure is repeated for four times, giving information as to how the catchment efficiency of the sponges changes.

[0040] The above experiments were complemented by similar measurements in which the sponges are replaced with conventional palladium-based recovery gauzes (4 gauzes with 76 micron wire and 1024 woven mesh size).

[0041] The catchment efficiency of the system (upper and lower sponges and palladium-based gauzes) is made by determining the platinum weight loss from the combustion gauzes (normalised to area - g Pt / cm^2 reactor), and the weight increase of platinum in the sponges and lower recovery gauzes; again normalised to area.

[0042] Data for platinum recovery on the upper and lower Pd-coated sponges are shown in Table 3.

Table 3.

	Combustion Gauzes	Upper Pd Coated Sponge		Lower Pd Coated Sponge		Lower Pd Gauzes
Days on Stream	Pt Loss / $mg.cm^{-2}$	Pt Gain / $mg.cm^{-2}$	% Recovery	Pt Gain / $mg.cm^{-2}$	Total % Recovery	Pt Gain / $mg.cm^{-2}$
8.02	2.4419	2.4105	98.7	0.3255	100+	0
13.99	3.9004	3.727	95.6	0.5642	100+	0
18.45	5.1557	4.705	91.2	0.7378	100+	0
26.22	7.9957	6.901	86.3	0.8246	96.6	0

[0043] There was no indication of platinum being recovered on the lower Pd-based gauzes, located below the lower Pd-Coated sponge.

[0044] The data for platinum recovery on conventional palladium-based recovery gauzes, tested under the same conditions as the above, are shown in Table 4.

Table 4.

	Combustion Gauzes	Conventional Pd Recovery Gauzes	
Days on Stream	Pt Loss / mg.cm^{-2}	Pt Gain / mg.cm^{-2}	% Recovery
6.81	2.0461	1.6757	85.9
13.33	3.908	3.1511	80.6
20.1	6.0095	4.9222	81.9
27.07	8.4286	6.7558	80.2
33.1	11.3177	7.8110	69.0

[0045] It is clearly demonstrated that the recovery efficiency of the Pd-coated sponges is superior to that of conventional recovery gauzes, when the same area mass of palladium is installed (compare the recovery efficiency of the first sponge layer with the gauze-based system. By installing a large amount of palladium (i.e. the addition of a second sponge) the recovery efficiency is enhanced further.

[0046] The second issue regarding platinum recovery using palladium-based system, is the amount of palladium lost during the recovery of platinum. Experience has shown, that when using gauze-based recovery systems, approximately 1 g of palladium is lost, when recovering 1 g of platinum.

Table 5 shows the palladium losses during platinum recovery, for a Pd-coated sponge and a pure palladium alloy.

Platinum Recovery on gauze/g	Palladium Loss On gauze/g	Ratio Pd loss / Pt recovery	Platinum Recovery on sponge/g	Palladium Loss on sponge/g	Ratio Pd loss / Pt recovery
1.14	0.93	0.81	1.18	0.87	0.73
1.85	1.77	0.95	1.82	1.27	0.69
2.60	2.43	0.93	2.30	1.40	0.61
2.84	2.54	0.89	3.39	1.42	0.41

[0047] It is clearly demonstrated that the palladium loss, during platinum recovery, is significantly lower with the Pd-coated sponge than with a conventional Pd-gauze based system.

Claims

1. A platinum group metal (PGM) catching device comprising a ceramic body, **characterised in that**

- the ceramic body is a ceramic foam or sponge of which at least a part of the surface area is covered by one or more PGM-catching metal(s)/alloy(s), wherein
- the ceramic foam or sponge is made of one or more of the following materials; zirconia, alumina, alumino-silicate or a refractory oxide, silicate, carbide, boride, phosphate, nitride or a refractory metal,
- and has a porosity in the range of 50 - 98 % and a pore size, defined by the number of pores per length, in the range of 2 - 50 pores/cm.

2. Device according to claim 1,
characterised in that the ceramic body is covered by a layer of palladium as PGM-catching metal/alloy.

3. Device according to claim 2,
characterised in that the ceramic body is a zirconia sponge with a porosity in the range of 50 - 98 % and about 18 pores/cm, and which is coated with approximately 55 mg palladium per cm^3 sponge.

4. Device according to claim 2,
characterised in that the ceramic body is a zirconia sponge with a porosity in the range of 50 - 98 % and about 31 pores/cm, and which is coated with approximately 130 mg palladium per cm^3 sponge.

5. Use of the device according to any of claims 1 to 4 for catching platinum group metals in a gaseous state.

Patentansprüche

1. Vorrichtung zum Auffangen von Platingruppen-Metallen (PGM), die einen Keramikkörper umfasst, **dadurch gekennzeichnet, dass**

   - der Keramikkörper ein keramischer Schaum oder Schwamm ist, bei dem mindestens ein Teil der Oberfläche mit einem/einer oder mehreren PGM-auffangenden Metall(en)/Legierung(en) bedeckt ist, worin
   - der keramische Schaum oder Schwamm aus einem oder mehreren der folgenden Materialien hergestellt ist: Zirkoniumoxid, Aluminiumoxid, Alumino-Silikat oder ein hochschmelzendes Oxid, Silikat, Carbid, Borid, Phosphat, Nitrid oder ein hochschmelzendes Metall,
   - und der eine Porosität im Bereich von 50 bis 98 % und eine Porengröße, definiert als die Anzahl der Poren pro Länge, im Bereich von 2 bis 50 Poren/cm hat.

2. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, dass** der Keramikkörper mit einer Schicht aus Palladium als PGM-auffangende(s) Metall/Legierung bedeckt ist.

3. Vorrichtung gemäß Anspruch 2, **dadurch gekennzeichnet, dass** der Keramikkörper ein Zirkoniumoxidschwamm mit einer Porosität im Bereich von 50 bis 98 % und etwa 18 Poren/cm ist, der mit ungefähr 55 mg Palladium pro cm^3 Schwamm beschichtet ist.

4. Vorrichtung gemäß Anspruch 2, **dadurch gekennzeichnet, dass** der Keramikkörper ein Zirkoniumoxidschwamm mit einer Porosität im Bereich von 50 bis 98 % und etwa 31 Poren/cm ist, der mit ungefähr 130 mg Palladium pro cm^3 Schwamm beschichtet ist.

5. Verwendung der Vorrichtung gemäß irgendeinem der Ansprüche 1 bis 4 zum Auffangen von Platingruppen-Metallen in einem gasförmigen Zustand.

Revendications

1. Dispositif de capture de métaux du groupe du platine (MGP), comprenant un corps en céramique, **caractérisé en ce que**

   - le corps en céramique est une mousse ou une éponge en céramique dont au moins une partie de la surface est recouverte d'un ou plusieurs métaux/alliages de capture de MGP, dans lequel
   - la mousse ou l'éponge en céramique est fabriquée à partir d'un ou plusieurs des matériaux suivants : zircone, alumine, aluminosilicate ou oxyde réfractaire, silicate, carbure, borure, phosphate, nitrure ou métal réfractaire,
   - et présente une porosité comprise entre 50 et 98 % et une taille de pores, définie par le nombre de pores par unité de longueur, comprise entre 2 et 50 pores/cm.

2. Dispositif selon la revendication 1, **caractérisé en ce que** le corps en céramique est recouvert d'une couche de palladium en tant que métal/alliage de capture de MGP.

3. Dispositif selon la revendication 2, **caractérisé en ce que** le corps en céramique est une éponge en zircone présentant une porosité comprise entre 50 et 98 % et environ 18 pores/cm, et revêtue d'environ 55 mg de palladium par cm^3 d'éponge.

4. Dispositif selon la revendication 2, **caractérisé en ce que** le corps en céramique est une éponge en zircone présentant une porosité comprise entre 50 et 98 % et environ 31 pores/cm, et revêtue d'environ 130 mg de palladium par cm^3 d'éponge.

5. Utilisation du dispositif selon l'une quelconque des revendications 1 à 4, pour capturer les métaux du groupe du platine à l'état gazeux.

Figure 1. Palladium coating on a zirconia sponge

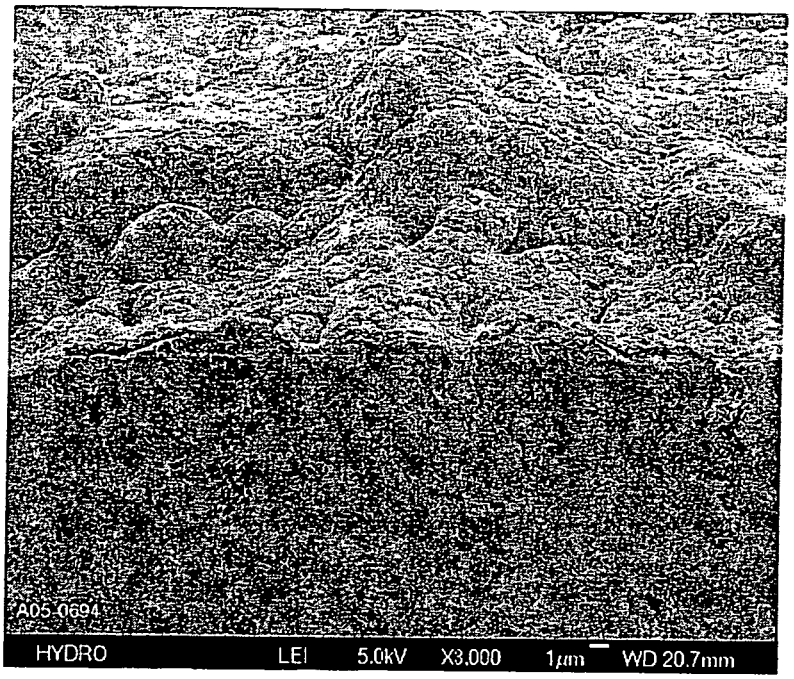


Figure 2. palladium coating on a zirconia sponge

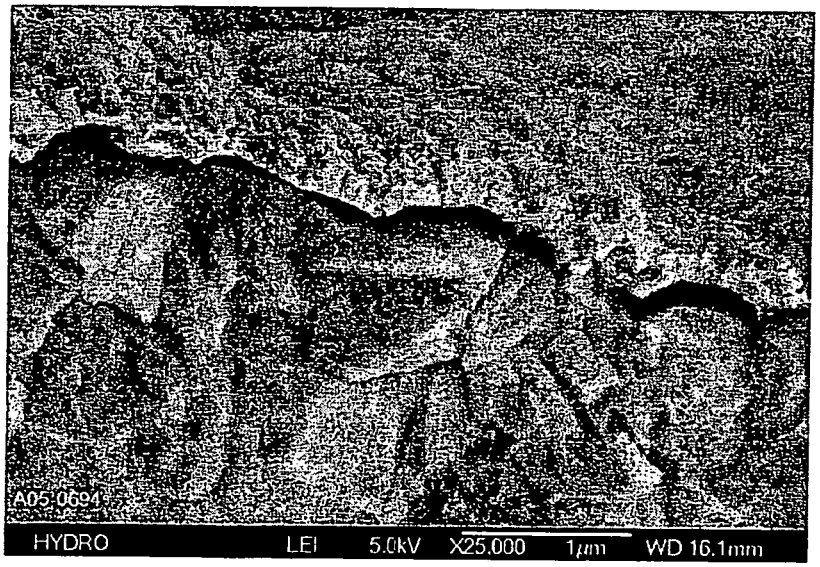
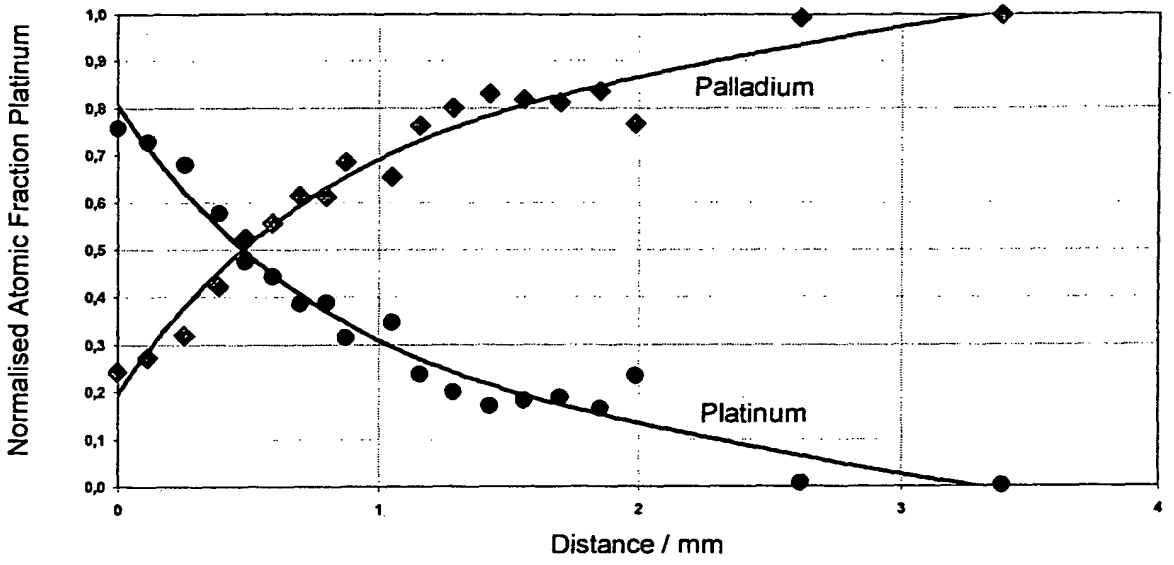


Figure 3. Platinum up-take on a Pd-coated zirconia sponge



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0275681 A **[0007]**
- US 5478549 A **[0008]**
- US 4774069 A **[0009]**
- EP 0185510 A **[0010]**
- GB 1343637 A **[0011]**
- GB 1314874 A **[0012]**
- JP 061920253 B **[0013]**